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(54) Title: SALT SUBSTITUTE (57) Abstract A salt substitute, which is essentially free of sodium ion, is described which comprises a preponderant amount of ammonium chloride, a lesser and effective amount of one or more pH adjusters to suppress the bitter taste of the ammonium chloride and to prevent the formation of ammonia gas when the salt substitute is used, and a lesser and effective amount of sugar to reduce sourness when the salt substitute is used.		

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SALT SUBSTITUTE

The present invention relates to a salt substitute, and particularly to a salt substitute for use in low sodium diets.

BACKGROUND OF THE INVENTION

It is well established that restriction of sodium ion in the diet can be a vital factor in the treatment and regulation of chronic congestive heart failure, hypertension, certain types of kidney disease, advanced cirrhosis of the liver and numerous other maladies. Clinical studies have demonstrated the risk to a person's state of health when sodium ion is taken in excess of proper needs.

Many studies relating to hypertension and vascular disease have shown restoration or normalization of the system when sodium ion intake is reduced. As a consequence, numerous formulations have been proposed to replace sodium chloride to maintain the palatability of the food in the diet. Many of these past formulations are based on the replacement of the sodium cation with potassium, ammonium, lithium and calcium, on the one hand, and by anions such as chlorides, phosphates and glutamates, on the other. Some of these formulations do not fulfill the broad range of salt-like sensory reaction normally obtained with sodium chloride. Sodium chloride taste response is a complex reaction that includes not only saltiness but also intensity, persistency, and aftertaste.

Many of the present compositions are based on potassium chloride in place of sodium chloride. For example, U.S. Pat nt No. 3,860,732 to B. Eisenstadt describes salt substitutes containing a preponderant amount of potassium chloride. In addition to being bitter,

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prolonged utilization of excessive potassium can lead to complications in the gastrointestinal tract, in the heart or in the muscles.

Ammonium chloride, which has been used alone or in combination with potassium chloride, has not found favor due to the fact that it is thought to have a bitter taste and can form ammonium gas in an alkaline environment. Ammonium chloride is, however, a more desirable composition to use in a salt substitute due to its intensity of salty flavor which is greater than that of potassium chloride. It is desirable to formulate a salt substitute based on ammonium chloride which avoids the bitterness problems known in the prior art and which prevents the ammonium chloride from forming ammonia gas.

Japanese Kokai 58/187,170 (abstracted in Chemical Abstracts, Vol. 100, 66962e [1984]) describes a salt substitute containing disodium citrate and ammonium chloride at a 1:2 mole ratio. If the components of this composition are expressed, however, on a weight basis, the amount of ammonium chloride is less than the amount of disodium citrate. One would also expect a sour taste for the composition due to the presence of the citrate ion. The composition, moreover, is rather rich in sodium ion and would not be desirable for use in sodium-restricted diets.

SUMMARY OF THE INVENTION

The salt substitute of the present invention is, preferably, essentially free of sodium ion and comprises a preponderant amount of ammonium chloride, a lesser effective amount of one or more pH adjusters which act to suppress the bitter taste of the ammonium chloride and also prevent the formation of ammonia gas when the salt substitute is used, and a lesser effective amount of sugar to reduce sourness when the salt substitute is used.

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DETAILED DESCRIPTION OF THE PRESENT INVENTION

The present invention contains three essential components. The first is a preponderant amount of ammonium chloride. The second essential component is one or more pH adjusters which are present in lesser amount than the amount of ammonium chloride and which act to suppress the bitter taste normally generated by ammonium chloride and also prevent the formation of ammonia gas when the salt substitute is used. The third essential component is a lesser and effective amount of sugar which acts to reduce the sour taste that would normally be generated if only the ammonium chloride and pH adjusters were present in the composition.

Ammonium chloride is present in preponderant amount in the salt substitute of the present invention and is responsible for the salty taste which the salt substitute presents. Generally speaking, amounts of ammonium chloride of from about 40% to about 55% by weight of the composition can be used, preferably about 50% by weight.

In order to suppress the normally bitter taste that ammonium chloride has, and to prevent the formation of ammonia gas arising from use of the ammonium chloride component, the present invention contemplates the use of one or more pH adjusters. The amount of pH adjuster component that is used in the instant salt substitute is less than the amount of ammonium chloride that is employed. Effective amounts of such pH adjusters are deemed to be in the range of from about 20%, by weight, to about 30%, by weight of the entire composition. The type of pH adjusters contemplated for use, either alone or in admixture, in connection with the present invention are those alkali metal and alkaline earth metal salts of acids which are ionizable in water and which lower the pH of the resulting composition. The one which is chosen for use should be of relatively small size so as not to detract from the salty taste provided by the

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ammonium chloride. The anion portion can be selected from relatively strong mineral acids (e.g., phosphoric acid) as well as weaker organic acids (e.g., tartaric acid). The phosphate anion has been found to be especially useful since it is of the desired small size and it is formed from a relatively strong acid. It has been found that potassium ion-containing pH adjusters are preferable since these compounds do not contribute undesired sodium ion to the composition. Generally speaking, a weight amount of about 25% by weight of such pH adjusters has been found to be especially suitable. Blends of potassium phosphate monobasic and potassium bitartrate have been found to be especially useful. Generally speaking, the pH adjuster or adjusters which are used should produce a pH value of from about 3.7 to about 4.0 when the salt substitute is dissolved in water.

The third type of essential component of the present invention is sugar which acts to suppress the normally sour taste that would be generated if the ammonium chloride and pH adjuster components were used alone. Examples of sugars which can be used include the naturally occurring types (e.g., sucrose, dextrose, fructose, etc.) as well as synthetic versions (e.g., aspartame, etc.). Sucrose has been found to be especially effective since it is not so perceptibly sweet as to mask the desired salty taste of the resulting salt substitute composition. It is deemed that this component can be present at from about 20% to about 30% by weight of the entire composition. Weight amounts of about 25% by weight have been found to be especially suitable.

The Examples which follow set forth certain embodiments of the present invention.

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EXAMPLE 1

A blend of 50%, by weight, ammonium chloride, 20%, by weight, potassium phosphate monobasic, 5%, by weight, potassium bitartrate, and 25%, by weight, sucrose was prepared as a salt substitute.

Blends of this salt substitute with water, chicken broth and mashed potatoes were prepared at a 1%, by weight, level of the salt substitute. The pH values of the water solution, chicken broth and mashed potatoes, without any salt substitute, were 5.8, 6.4 and 5.9 respectively. The following results were obtained in comparison with a commercially available salt substitute:

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<u>Substrate</u>	(Comm. Prdct.) <u>pH</u>	(Salt Subst.) <u>pH</u>	<u>Taste Results*</u>
Water Sol'n.	3.7	3.8	Instant salt substitute was more salty and more sour than commercial salt substitute. Both were slightly bitter.
Chicken Broth	5.2	5.5	Instant salt substitute was more salty and more sharply sour than the commercially available salt substitute.
Mashed Potatoes	5.6	5.6	Instant salt substitute was more salty and more sharply sour than the commercial salt substitute. The rinse water from the commercial salt substitute was bitter.

*These taste results are based on the impressions of a taste panel of volunteers. It is to be understood that individual tastes are subject to variation and that differing panels might have differing responses to the same formulations.

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EXAMPLE 2

This Example presents other formulations which contain ammonium chloride, potassium phosphate monobasic, potassium bitartrate, and sucrose in amounts varied from those given in Example 1.

	<u>A</u>	<u>B</u>	<u>C</u>
Ammonium chloride	50	50	50
Potassium phosphate, monobasic	24.5	23	25
Potassium bitartrate	0.5	2	4
Sucrose	25.0	25	21

The pH of water, chicken broth, or mashed potatoes containing them at the 1% level was as follows:

	<u>A</u>	<u>B</u>	<u>C</u>
Water solution	4.6	4.1	3.9
Chicken broth	5.7	5.6	5.3
Mashed Potatoes	5.7	5.6	5.6

In general the taste results for these three additional blends were as follows:

A: This blend was salty, weakly sour and moderately bitter.

B: This blend was salty, more sour than Blend A and was less bitter.

C: This blend was salty, more sour than either Blend A or B and was less bitter than either Blend A or B.

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The foregoing Examples are presented for illustrative purposes only and should not be construed in a limiting sense. The scope of protection that is sought is set forth in the claims which follow.

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I Claim:

1. A salt substitute which comprises:
 - (a) a preponderant amount of ammonium chloride;
 - (b) a lesser effective amount of one or more pH adjusters to suppress the bitter taste of the ammonium chloride and prevent the formation of ammonia gas when the salt substitute is used; and
 - (c) a lesser effective amount of sugar to reduce sourness when the salt substitute is used.
2. A salt substitute as claimed in Claim 1 wherein the pH adjuster is one or more potassium salts.
3. A salt substitute as claimed in Claim 1 wherein the sugar is sucrose.
4. A salt substitute as claimed in Claim 1 wherein
 - (a) is present at from about 40% to about 55%, (b) is present at from about 20% to about 30%, and (c) is present at from about 20% to about 30%.
5. A salt substitute as claimed in Claim 4 wherein (b) is an alkali metal or alkaline earth metal salt of an acid and (c) is sucrose.
6. A salt substitute as claimed in Claim 5 wherein (b) comprises a phosphate.
7. A salt substitute as claimed in Claim 4 wherein (b) comprises potassium phosphate and (c) comprises sucrose.
8. A salt substitute as claimed in Claim 7 wherein (b) is a mixture of potassium phosphate and potassium bitartrate.

INTERNATIONAL SEARCH REPORT

International Application No. PCT/US88/01614

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶ According to International Patent Classification (IPC) or to both National Classification and IPC IPC(4): A23L 1/237 U.S. CL.: 426/649; 650																										
II. FIELDS SEARCHED <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black; margin: 5px 0;">Minimum Documentation Searched ⁷</div> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%; border: 1px solid black; padding: 5px;">Classification System</td> <td style="border: 1px solid black; padding: 5px;">Classification Symbols</td> </tr> <tr> <td style="border: 1px solid black; padding: 5px;">U.S</td> <td style="border: 1px solid black; padding: 5px;">426/649, 650</td> </tr> </table> <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black; margin: 5px 0;">Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸</div>			Classification System	Classification Symbols	U.S	426/649, 650																				
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U.S	426/649, 650																									
III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹ <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 10%; border: 1px solid black; padding: 5px;">Category [*]</th> <th style="width: 70%; border: 1px solid black; padding: 5px;">Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²</th> <th style="width: 20%; border: 1px solid black; padding: 5px;">Relevant to Claim No. ¹³</th> </tr> <tr> <td style="border: 1px solid black; text-align: center; padding: 5px;">Y</td> <td style="border: 1px solid black; padding: 5px;">US, A, 3,860,732 (EISENSTADT) 14 JANUARY 1975, SEE ENTIRE DOCUMENT.</td> <td style="border: 1px solid black; text-align: center; padding: 5px;">1, 2</td> </tr> <tr> <td style="border: 1px solid black; text-align: center; padding: 5px;">Y</td> <td style="border: 1px solid black; padding: 5px;">US, A, 4,243,691 (MOHLENKAMP ET AL) 06 JANUARY 1981, SEE ENTIRE DOCUMENT.</td> <td style="border: 1px solid black; text-align: center; padding: 5px;">3</td> </tr> <tr> <td style="border: 1px solid black; text-align: center; padding: 5px;">A</td> <td style="border: 1px solid black; padding: 5px;">US, A, 2,968,566 (MUNCH) 17 JANUARY 1961, SEE ENTIRE DOCUMENT.</td> <td style="border: 1px solid black; text-align: center; padding: 5px;">1</td> </tr> <tr> <td style="border: 1px solid black; text-align: center; padding: 5px;">A</td> <td style="border: 1px solid black; padding: 5px;">US, A, 2,824,008 (PERRI) 18 FEBRUARY 1958, SEE ENTIRE DOCUMENT.</td> <td style="border: 1px solid black; text-align: center; padding: 5px;">1</td> </tr> <tr> <td style="border: 1px solid black; text-align: center; padding: 5px;">A</td> <td style="border: 1px solid black; padding: 5px;">US, A, 2,742,366 (POWER) 17 APRIL 1956, SEE ENTIRE DOCUMENT.</td> <td style="border: 1px solid black; text-align: center; padding: 5px;">1</td> </tr> <tr> <td style="border: 1px solid black; text-align: center; padding: 5px;">A</td> <td style="border: 1px solid black; padding: 5px;">US, A, 2,601,112 (FREEDMAN) 17 JUNE 1952, SEE ENTIRE DOCUMENT</td> <td style="border: 1px solid black; text-align: center; padding: 5px;">1</td> </tr> <tr> <td style="border: 1px solid black; text-align: center; padding: 5px;">A</td> <td style="border: 1px solid black; padding: 5px;">US, A, 2,471,144 (DAVY) 24 MAY 1949, SEE ENTIRE DOCUMENT</td> <td style="border: 1px solid black; text-align: center; padding: 5px;">1</td> </tr> </table>			Category [*]	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³	Y	US, A, 3,860,732 (EISENSTADT) 14 JANUARY 1975, SEE ENTIRE DOCUMENT.	1, 2	Y	US, A, 4,243,691 (MOHLENKAMP ET AL) 06 JANUARY 1981, SEE ENTIRE DOCUMENT.	3	A	US, A, 2,968,566 (MUNCH) 17 JANUARY 1961, SEE ENTIRE DOCUMENT.	1	A	US, A, 2,824,008 (PERRI) 18 FEBRUARY 1958, SEE ENTIRE DOCUMENT.	1	A	US, A, 2,742,366 (POWER) 17 APRIL 1956, SEE ENTIRE DOCUMENT.	1	A	US, A, 2,601,112 (FREEDMAN) 17 JUNE 1952, SEE ENTIRE DOCUMENT	1	A	US, A, 2,471,144 (DAVY) 24 MAY 1949, SEE ENTIRE DOCUMENT	1
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<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>[*] Special categories of cited documents: ¹⁰</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&" document member of the same patent family</p> </div> </div>																										
IV. CERTIFICATE																										
Date of the Actual Completion of the International Search 02 August 1988	Date of Mailing of this International Search Report 02 SEP 1988																									
International Searching Authority ISA/US	Signature of Authorized Officer <i>Mary S. Mims</i> Mary S. Mims																									

FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

A CHEMICAL ABSTRACT, VOLUME 100, NO. 9,
ISSUED 27 FEBRUARY 1984 (COLUMBUS, OHIO,
USA), TAKEUCHI, K., "SALT SUBSTITUTE
COMPOSITION NO. 4", SEE PAGE 494, COLUMN 2,
THE ABSTRACT NO. 66967, JAPANESE PATENT
58,187,164, 1983

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V. ☐ OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE¹

This International search report has not been established in respect of certain claims under Article 17(2) (a) for the following reasons:

1. ☐ Claim numbers _____, because they relate to subject matter¹² not required to be searched by this Authority, namely:

2. ☐ Claim numbers _____, because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out¹², specifically:

3. ☐ Claim numbers _____, because they are dependent claims not drafted in accordance with the second and third sentences of PCT Rule 5.4(a).

VI. ☐ OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING²

This International Searching Authority found multiple inventions in this international application as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:

4. ☐ As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

Remark on Protest

☐ The additional search fees were accompanied by applicant's protest.

☐ No protest accompanied the payment of additional search fees.